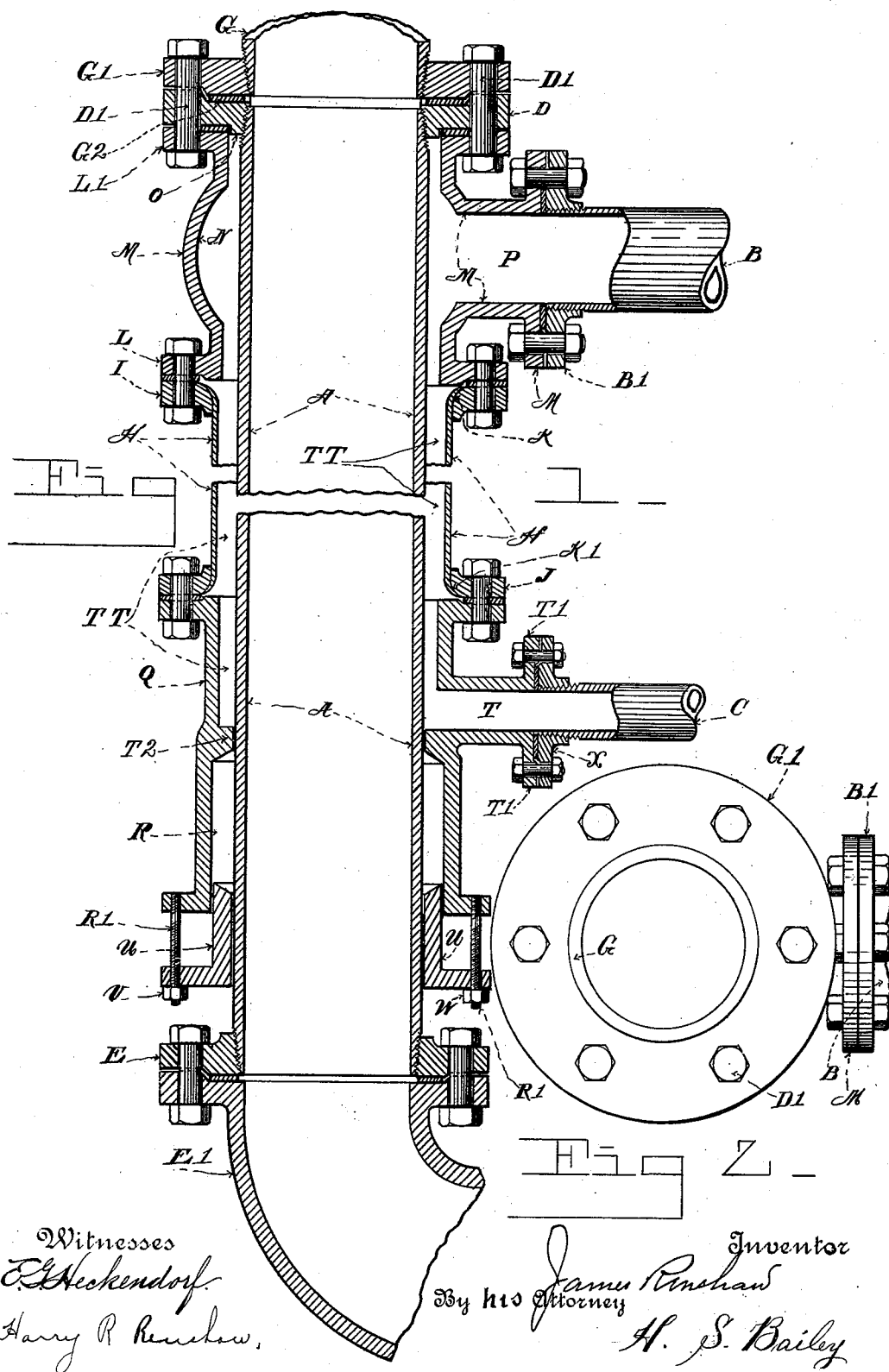


(No Model.)

J. RENSHAW.
SURFACE CONDENSER.

No. 545,612.

Patented Sept. 3, 1895.



UNITED STATES PATENT OFFICE.

JAMES RENSHAW, OF DENVER, COLORADO.

SURFACE CONDENSER.

SPECIFICATION forming part of Letters Patent No. 545,612, dated September 3, 1895.

Application filed December 28, 1894. Serial No. 533,194. (No model.)

To all whom it may concern:

Be it known that I, JAMES RENSHAW, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Surface Condensers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in steam-condensers, and particularly to that class of steam-condensers known as "surface" condensers; and the objects of my invention are, first, to provide a surface condenser adapted to pumps and pumping-engines; second, to provide a surface condenser especially adapted to station and sinking pumps used in deep mining; third, to provide a surface condenser in which the column of water discharged by the pump acts as the refrigerating medium; fourth, to provide a surface condenser which can be attached to the station and sinking pumps at present in use in mines, and one which does not require additional space to that occupied by the pump and its suction and delivery pipes; fifth, to provide a pump surface condenser in which the water-plungers fulfill the functions of an air-pump and create and maintain a vacuum in the condenser equal to the vacuum created by the plungers in the suction-pipe. I attain these objects by the mechanism illustrated and described in the accompanying drawings and specification, in which—

Figure 1 represents a sectional elevation of my improved surface condenser. Fig. 2 represents a plan view of the same.

Similar letters of reference refer to similar parts throughout both the views.

Referring to Fig. 1, A designates a pump delivery-pipe, which may be connected to any make, style, or size of pump. I do not show a pump connected to the condenser, but simply show the exhaust-steam pipe B, which connects the steam-chest of the pump to the condenser, and the condenser discharging-pipe C, which connects the condenser to the

suction-pipe of the pump. The pipe A represents, in practical use preferably, one standard length of pipe, which is eighteen feet. It is threaded at both ends, as is usual, and to each end I thread a flange D and E. At the lower end a flanged elbow E' is represented bolted to the flange E. This elbow leads to and is secured to the discharge-opening of the pump. It is used when the discharge-pipe stands in a vertical shaft and the pump has a side delivery; but if the pipe stands horizontal to the pump, or the pump has a top discharge-opening, this length is bolted directly to the pump or a short piece is interposed between them. At the opposite end of the pipe A the adjacent length of pipe G is also provided at its end with a flange G', which is threaded thereto. Through both flanges bolt-holes are drilled to register, and the flange G' and the pipe G are bolted to the flange D by the bolts D'. One flange is provided with a counterbore and the other with a projection fitting therein, but of less depth, leaving a space between the two, in which I place a gasket G². All the joints of the condenser are preferably made in a similar manner. I surround the pipe A with a larger pipe H for the greater part of its length. I preferably use boiler-tubing for this outer pipe. It is lighter and less expensive. This pipe H constitutes the central portion of the condenser and in a full-sized condenser will be about 14 feet long. On each end I shrink a flange I and J, and I further secure it by turning the edges of the pipe outward, as shown at K and K'. The upper end of this pipe and the flange I bolts to a flange L, which is a part of the condenser-head M. This head is also larger in diameter than the pipe A, especially at its central part N, where I shape it to form quite a chamber around the pipe A. The condenser-head also bolts to the flange D of the pipe A, the bolts D' passing through its top flange L'. A depending circular lip O is formed on the said flange D, close to the pipe A. It is adapted to fit into the bore of the head and hold it concentric with the pipe. I provide the head of the condenser with a flanged projecting outlet P, which enables it to be bolted to the flange B' of the exhaust-steam pipe B. The opposite end of the condenser is composed of a cylindrical casting Q. This casting is

flanged at both ends similar to the head. One end is bolted to the body of the outer casing or pipe H, and in the other end of the casting a stuffing-box R is formed by counterboring to a desired depth and fitting a flanged gland into the counterbore, which is packed to make a tight joint around the pipe. This casting is provided with a flanged projecting outlet T for the egress of the water which collects as the steam is condensed. The said outlet is arranged close to the bottom of the condensing-chamber T T, the casting being shaped interiorly at this point to form an introverted lip T², which fits the surface of the delivery-pipe A and forms the bottom of the condensing-chamber. The flanged gland U, which fits into the stuffing-box R, is adjustably secured to the flange of the casting by the studs R' and the nuts V and W. The flange T' of the outlet T bolts to the flange X of the suction-pipe C. This pipe leads to the suction-pipe of the pump and can be connected at any convenient part of it, but it is better to connect it just below the pump. I preferably use flanged and bolted joints in the place of internal and external threads or couplings, because it is a much better, easier, quicker, and surer way of making and breaking joints in small spaces.

Before I describe the operation of the condenser I desire to state some of the objectionable features met with in getting rid of or condensing the exhaust-steam from station and sinking pumps in deep mines. It is obvious that this kind of condenser can be used on all kinds of pumping plants, and can also be applied to steam-engines if means are employed to keep a stream of cold water flowing through the interior pipe; but it has been especially designed for the use in gold, silver, copper, and similar operative mines, where small and deep shafts are used. Mining-shafts vary from four by eight to six by twelve feet square. This space is timbered and is subdivided by timber partitions to form a shaft for the cage or bucket and a shaft for the pump, and generally a ladder-shaft for the men. Consequently the space allotted to the station or sinking pump seldom exceeds but by a few inches, except at the levels of tunnels, the size of the pump. The live steam is piped in covered pipes to the pump, which may be several hundred feet below the surface. The exhaust-steam must either be returned to the surface or condensed at or near the pump. It requires expensive piping to carry it again to the surface, as it must be covered in order to keep the shaft cool, and again the condensed water from the exhaust causes back-pressure on the pump. Consequently this method is not practical in many cases. The exhaust-steam must consequently be condensed. There are two ways of doing this in common use in the mines. One is to turn the steam directly into the sump, which is a hole sunk below the station-pump to catch the seepage from the shaft

and levels above, and it is at this point confined in a small space that the pump is kept at work to keep the water below the lowest level. This method is objectionable because the suction-pipe must extend to within a foot or so of the bottom of the sump and the exhaust must be carried below the suction. If this is not done and the pump gains on the water, the exhaust will eventually be delivered in the atmosphere of the mine, filling it full of steam, which must be avoided. If it is so arranged and the pump is run at intervals, the exhaust will exhaust against the pressure of a number of feet of water, sometimes a good many. This method also keeps the sump-water hot and tends to heat the mine, and owing to the constant agitation of the water loosens the suction-pipe at its union with the pump. Another method is to run the exhaust-pipe into the suction-pipe. This is objectionable, for the reason that the pump will not always catch the water the first two or more strokes, in which case the exhaust flows directly into the pump-cylinder, heating it up and preventing its catching the water, as a hot pump will not draw. Again, after the pump is running the steam enters the suction-pipe in a volume at each stroke and more or less is carried into the cylinder, causing the pump-valves to keep up a continuous knocking. I have mentioned these methods, as they are the only ones in use in mining-shafts.

There are a great many good steam-condensers, but they are not adapted to the conditions found in underground mining.

The operation of my condenser is as follows: As soon as the pump is started up, the exhaust-steam enters the condenser through the pipe B and surrounds the delivery-pipe A, filling the condenser-chamber T T. This chamber being about sixteen feet long, if confined to one length of pipe the steam has quite a distance to travel before it reaches the suction-pipe of the pump, and as the delivery-pipe A is always cold the steam is condensed and the water therefrom flows out of the outlet T, through the outlet-pipe C, into the suction-pipe of the pump. The delivery-pipe averages in the size of mining-pumps in general use from four to five times the area of the exhaust-pipe. Consequently in a length of sixteen or more feet a very large area of cold surface is exposed to the steam. Then, again, the cold atmosphere of the mine, together with the constant dripping of seepage-water on the outside surface of the condenser, materially aids in condensing the steam, which is almost completely condensed before it reaches the end of the condensing-chamber. When the pump is first started, if it does not catch water the first few strokes, the pipe A is cold enough to condense the greater portion of the steam before it reaches the suction-pipe, and as soon as it catches the water a continual stream of cold water is forced constantly through it, thereby keeping

it always cold. The pump-plungers create a vacuum in the condenser equal to the vacuum it creates in the suction-pipe. The amount of this vacuum in pounds varies according to the height of the pump-plungers above the water-level. Thus if the pump is placed eight feet above the water-level the vacuum in the suction-pipe will be four pounds and the vacuum in the lower part of the condenser adjacent to T will also be four pounds, and as the steam is almost entirely condensed this four pounds of vacuum is constant throughout the condenser to the steam-chest and cylinder and therefore relieves the steam-piston of that amount of back pressure, thereby increasing the capacity of the pump or enabling it to do the same work with less steam, besides ending all annoyance with the exhaust. If the pump is placed twenty feet above the water-level, the vacuum in the suction-pipe and in the condenser will be ten pounds in each. Consequently there will be approximately ten pounds back pressure per square inch taken from the steam-piston, and as the area of the steam-piston is generally from four to five times that of the plungers every pound of vacuum takes that amount of back pressure per square inch off of the piston.

This condenser can be attached to any pump at present in use in the mines. It does not require any additional space. It is simple, inexpensive, durable, and makes a perfect condenser.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of one or more lengths of pipe interposed in the pipe delivery of a pump in juxtaposition to its water cylinder,

and provided with pipe connections at each end, a cylindrical casting surrounding said pipe and secured at one end to one of said pipe connections, a depending lip on said pipe connection extending into said casting adapted to hold it concentric to said pipe, a casing surrounding said pipe and secured to said cylindrical casting, a second cylindrical casting secured to the opposite end of said casing and provided with a stuffing box and gland whereby it may be packed around the said inner pipe, an exhaust inlet in the first named casting and a condensed water outlet in the second named casting connected respectively to the exhaust and suction pipes of a pump, as set forth.

2. The combination with one or more lengths of pipe interposed in the delivery pipe of a pump, provided with a flanged coupling at its end, of a cylindrical casting surrounding said pipe and secured to said coupling, a depending lip on said coupling extending into said casting, whereby it is held concentric to the pipe, a casing surrounding said pipe and secured to said cylindrical casting, a second cylindrical casting secured to the opposite end of said casing, an expansive joint arranged in said casting around said pipe, an exhaust inlet in the first named casting connecting with the pump's exhaust pipe and an outlet in the second named casting connected with the suction pipe of the pump or to an independent air pump, as specified.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES RENSHAW.

Witnesses:

EDWARD G. HECKENDORF,
HARRY R. RENSHAW.